03/18/98 JC535 U.S. PTO

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Practitioner's Docket No. P-5550 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of
Inventor(s):

Thomas Kennedy
Viktor Keller
William Risen

WARNING: Patent must be applied for in the name(s) of all of the actual inventor(s). 37 CFR 1.41(a) and 1.57(b).

For (title):

GOLF BALL WHICH INCLUDES
FAST-CHEMICAL-REACTION-PRODUCED
COMPONENT AND METHOD OF MAKING SAME

09/040950

CERTIFICATION UNDER 37 C.F.R. 1.10*

(Express Mail label number is **mandatory**.)
(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date March 18, 1998, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EM 484761883 US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Janneke Case
(type or print name of person mailing paper)

Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

WARNING: Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. 1.10(b).

"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct.24, 1996, 60 Fed. Reg. 56,439, at 56,442.

15. Authorization to Charge Additional Fees

WARNING: If no fees are to be paid on filing, the following items should not be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

X The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No.

X 37 C.F.R. 1.16(a), (f) or (g) (filing fees)

X 37 C.F.R. 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims canceled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

X 37 C.F.R. 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

X 37 C.F.R. 1.17 (application processing fees)

WARNING: While 37 CFR 1.17(a), (b), (c) and (d) deal with extensions of time under § 1.136(a), this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 C.F.R. 1.136(a) is to no avail unless a request or petition for extension is filed." (Emphasis added). Notice of November 5, 1985 (1060 O.G. 27).

☐ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b).

NOTE. 37 CFR 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . issue fee." From the wording of 37 CFR 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

16. Instructions as to Overpayment

X Credit Account No. 17-0150

☐ Refund

SIGNATURE OF PRACTITIONER

Reg. No. 21011

Donald R. Bahr
(type or print name of attorney)

Tel. No. 813/204-5230

P.O. Box 30101
P.O. Address

Customer No.

Tampa, Florida 33630

13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.
(This and the surcharge required by 37 C.F.R. 1.16(e) can be paid subsequently.)

X Enclosed

X Basic filing fee	$ 1420.00
☐ Recording assignment ($40.00; 37 C.F.R. 1.21(h)) (See attached "COVER SHEET FOR ASSIGNMENT ACCOMPANYING NEW APPLICATION".)	$
☐ Petition fee for filing by other than all the inventors or person on behalf of the inventor where inventor refused to sign or cannot be reached ($130.00; 37 C.F.R. 1.47 and 1.17(h))	$
☐ For processing an application with a specification in a non-English language ($130.00; 37 C.F.R. 1.52(d) and 1.17(k))	$
☐ Processing and retention fee ($130.00; 37 C.F.R. 1.53(d) and 1.21(l))	$
☐ Fee for international-type search report ($40.00; 37 C.F.R. 1.21(e))	$

NOTE: 37 CFR 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(d).

Total fees enclosed $ 1420.00

14. Method of Payment of Fees

☐ Check in the amount of $________

X Charge Account No. 17-0150 in the amount of $ 1420.00

A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 CFR 1.22(b).

1. Type of Application

This new application is for a(n) (check one applicable item below)

_X_ Original (nonprovisional)
___ Design
___ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4), unless the International Application is being tied as a divisional, continuation or continuation-in-part application.

WARNING: Do not use this transmittal for the filing of a provisional application.

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

_ Divisional.
_ Continuation.
_ Continuation-in-part (C-I-P).

2. Benefit of Prior U.S. Application(s) (35 U.S.C. 119(e), 120, or 121)

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U. S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

WARNING: If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20 year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

WARNING: When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application must be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C. F. R. § 1.78(a)(3).

___ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed That Are Required for Filing Date under 37 C.F.R. 1.53(b) (Regular) or 37 C.F.R. 1.153 (Design) Application

_29_ Pages of specification
_4_ Pages of claims
_1_ Pages of Abstract
_3_ Sheets of drawing
___ formal
_X_ informal

WARNING: **DO NOT** submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 0.G. 57-62).

NOTE: "Identifing indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page." 37 C.F.R. 1.84(c)).

(complete the following, if applicable)

☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. 1.84(b).

4. Additional papers enclosed

☐ Preliminary Amendment
☐ Information Disclosure Statement (37 C.F.R. 1.98)
☐ Form PTO-1449 (PTO/SB/08A and 08B)
☐ Citations
☐ Declaration of Biological Deposit
☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
☐ Special Comments
☐ Other

5. Declaration or oath

X Enclosed
☐ Executed by
(check all applicable boxes)
☐ inventor(s).
☐ legal representative of inventor(s). 37 CFR 1.42 or 1.43.
☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.
☐ Not Enclosed.

WARNING: Where the filing is a completion in the U.S. of an International Application, but where a declaration is not available, or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

☐ Application is made by a person authorized under 37 C.F.R. 1.41(c) on behalf of all the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 CFR 1.16(e) can be filed subsequently).

NOTE: It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).

☐ Showing that the filing is authorized.
(not required unless called into question. 37 CFR 1.41(d))

6. Inventorship Statement

WARNING: If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

X The same.

OR

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

☐ is submitted.

☐ will be submitted.

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of $130.00 required by 37 CFR 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 CFR 1.52(d).

NOTE: A non-Engilsh oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(b)

X English

☐ Non-English

☐ The attached translation is a verified translation. 37 C.F.R. 1.52(d).

8. Assignment

☐ assignment of the invention to ____

____

_ is attached. A separate __ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or __ FORM PTO 1595 is also

☐ attached.

☐ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: A newly executed "CERTIFICATE UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

9. Certified Copy

Certified copy(ies) of application(s)

Country	Appln. no.	Filed
Country	Appln. no.	Filed
Country	Appln. no.	Filed

from which priority is claimed

- ☐ is (are) attached.
- ☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 C.F.R. 1.16)

A. __ Regular application

CLAIMS AS FILED

	Number filed	Number Extra	Rate	Basic Fee 37 C.F.R. 1.16(a) 790.00
Total Claims (37 CFR 1.16(c))	44 - 20 =		x 22	528.00
Independent Claims (37 CFR 1.16(b))	5 - 3 =		x 82	164.00
Multiple dependent claim(s), if any (37 CFR 1.16(d))			+	

- ☐ Amendment canceling extra claims is enclosed.
- ☐ Amendment deleting multiple-dependencies is enclosed.
- ☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims canceled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation $ 1420.00

B. ☐ Design application
($320.00---37 CFR 1.16(f))
Filing Fee Calculation $______________

C. ☐ Plant application
($530.00---37 CFR 1.16(g))
Filing Fee Calculation $______________

11. Small Entity Statement(s)

☐ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

WARNING: "Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. A nonprovisional application claiming benefit under 35 U.S.C. 119(e), 120, 121 or 365(c) of a prior application may rely on a verified statement filed in the prior application if the nonprovisional application includes a reference to a verified statement in the prior application or includes a copy of the verified statement filed in the prior application if status as a small entity is still proper and desired." 37 C.F.R. § 1.28(a).

(complete the following, if applicable)

☐ Status as a small entity was claimed in prior application ________/ ________________, filed on ________________, from which benefit is being claimed for this application under:

35 U.S.C. ☐ 119(e),
☐ 120,
☐ 121,
☐ 365(c),

and which status as a small entity is still proper and desired.

☐ A copy of the verified statement in the prior application is included.
Filing Fee Calculation (50% of A, B or C above)
$__________________________

NOTE: Any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendible under § 1.136 37 CFR 1.28(a).

12. Request for International-Type Search (37 C.F.R. 1.104(d))

(complete, if applicable)

☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)

☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added ____________________

☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added ______________________

☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added ______________________

☐ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)

X This transmittal ends with this page.

GOLF BALL WHICH INCLUDES FAST-CHEMICAL-REACTION-PRODUCED COMPONENT AND METHOD OF MAKING SAME

Field and Background of the Invention

The invention relates generally to golf balls, and more particularly to golf balls which contain a fast-chemical-reaction-produced component, such as a core and/or cover layer.

Golf balls comprise, in general, three types. The first type is a multi-piece wound ball wherein a vulcanized rubber thread is wound under tension around a solid or semi-solid core, and thereafter enclosed in a single or multi-layer covering of a tough, protective material. A second type of a golf ball is a one-piece ball formed from a solid mass of resilient material which has been cured to develop the necessary degree of hardness to provide utility. One-piece molded balls do not have a second enclosing cover. A third type of ball is a multi-piece non-wound ball which includes a liquid, gel or solid core of one or more layers and a cover having one or more layers formed over the core.

Conventional golf ball covers have been made of ionomer, balata, and slow-reacting, thermoset polyurethane. When polyurethane covers are made by conventional methods, such as by casting, a substantial amount of time and energy are required, thus resulting in relatively high cost.

It would be useful to develop a golf ball containing a fast-chemical-reaction-produced component, such as at least one core or cover layer, particularly one which contains polyurethane, polyurea, epoxy and/or unsaturated polyester.

Summary of the Invention

An object of the invention is to produce a golf ball having a polyurethane cover which is formed by a fast chemical reaction.

Another object of the invention is to provide a non-ionomeric golf ball cover which is efficiently produced by injection molding.

Yet another object of the invention is to provide a golf ball which contains polyurethane.

A further object of the invention is to provide a golf ball in which material from recycling polyurethane can be used to result in an efficient manufacturing process.

A further object of the invention is to produce a durable golf ball containing polyurethane, polyurea, epoxy, and/or unsaturated polyesters.

Another object of the invention is to provide a golf ball with a "seamless" cover layer, i.e., a cover layer having generally the same microscopic and molecular structure distribution both in the regions adjacent to the parting line of the mold and at locations which are not adjacent to the parting line, including near the poles.

Yet another object of the invention is to provide a method of making a golf ball of the type described above.

Other objects of the invention will become apparent from the specification, drawings and claims.

A preferred form of the invention is a method of making a multi-piece golf ball comprising making at least one of a cover component and a core component of the ball by mixing two or more materials that react to form a reaction product with a flex modulus of 5 - 310 kpsi in a reaction time of about 5 minutes or less, the component having a thickness of at least 0.01 inches and a demold time of 10 minutes or less including the reaction time.

The composition preferably comprises at least one member selected from the group consisting of polyurethanes, polyureas, epoxies and unsaturated polyesters. The reaction product preferably is formed by reaction injection molding. The component preferably has a thickness of at least 0.02 inches.

Another preferred form of the invention is a multi-piece golf ball comprising a reaction injection molded material comprising polyurethane/polyurea. The golf ball cover preferably has a Shore D hardness in the range of 20 - 95, more preferably 30 - 75, and a flex modulus in the range

of 5 - 310 kpsi, and more preferably 5 - 100 kpsi and even more preferably 10 - 80 kpsi. Preferably, at least 5% of the polyurethane/polyurea is formed from molecules obtained by recycling a material comprising at least one of polyurethane, polyurea, polyester and polyethylene glycol.

Yet another preferred form of the invention is a process for producing a golf ball including the step of reaction injection molding a polyurethane/polyurea material to form at least one of a core layer and a cover layer of the ball.

A further preferred form of the invention is a process for producing a golf ball comprising the steps of (a) reaction injection molding a polyurethane/polyurea component of the ball, and (b) recycling some of the polyurethane and/or polyurea that is produced in connection with step (a) but that is not incorporated in the golf ball in step (a). The polyurethane/polyurea preferably, but not necessarily, is recycled by glycolysis.

Yet another preferred form of the invention is a process for producing a golf ball comprising (a) forming a core, (b) covering the core, and (c) coating and adding indicia to the covered ball, wherein at least one of steps (a) and (b) comprises reaction injection molding of a polyurethane and/or polyurea material.

The golf ball of the invention can include, in the cover, optical brighteners, white pigment, UV stabilizers, antioxidants, etc. The cover and/or core may further include fillers such as TiO_2, glass, metal, and other fillers described below.

Yet another preferred form of the invention is a golf ball having a cover comprising a blend of polyurethane and ionomer, wherein the ionomer is a partially cation neutralized organic acid polymer, preferably an alpha, beta unsaturated carboxylic acid with 3 or more carbon atoms. The ionomer may be a polyurethane ionomer.

A further preferred form of the invention is a golf ball comprising at least one fast-chemical-reaction-produced layer, said layer having a flex modulus of 5 - 300 kpsi in a reaction time of 5 minutes or less and a thickness of at least 0.01".

Yet another preferred form of the invention is a golf ball having a core and a cover, the cover comprising polyurethane/polyurea which is formed from reactants, 5 - 100 weight percent of which are obtained from recycled polyurethane.

Brief Description of the Drawings

Fig. 1 is a first embodiment of a golf ball formed according to a reaction injection molded (RIM) process according to the invention.

Fig. 2 is a second embodiment of a golf ball formed according to a reaction injection molded (RIM) process according to the invention.

Fig. 3 is a third embodiment of a golf ball formed according to a reaction injection molded (RIM) process according to the invention.

Fig. 4 is a process flow diagram which schematically depicts a reaction injection molding process according to the invention.

Fig. 5 schematically shows a mold for reaction injection molding a golf ball cover according to the invention.

Detailed Description of the Invention

The present invention is a golf ball in which at least one cover or core layer is a fast-chemical-reaction-produced component. This component comprises at least one material selected from the group consisting of polyurethane, polyurea, polyurethane ionomer, epoxy, and unsaturated polyesters, and preferably comprises polyurethane. The invention also includes a method of producing a golf ball which contains a fast-chemical-reaction-produced component. A golf ball formed according to the invention preferably has a flex modulus in the range of 5 - 310 kpsi, a Shore D hardness in the range of 20 - 90, and good durability. Particularly preferred forms of the invention also provide for a golf ball with a

fast-chemical-reaction-produced cover having good scuff resistance and cut resistance. As used herein, "polyurethane and/or polyurea" is expressed as "polyurethane/polyurea".

A particularly preferred form of the invention is a golf ball with a cover comprising polyurethane, the cover including 5 - 100 weight percent of polyurethane formed from recycled polyurethane.

The method of the invention is particularly useful in forming golf balls because it can be practiced at relatively low temperatures and pressures. The preferred temperature range for the method of the invention is 120 - 180°F when the component being produced contains polyurethane. Preferred pressures for practicing the invention using polyurethane-containing materials are 200 psi or less and more preferably 100 psi or less. The method of the present invention offers numerous advantages over conventional slow-reactive process compression molding of golf ball covers. The method of the present invention results in molded covers in a demold time of 10 minutes or less. An excellent finish can be produced on the ball.

The method of the invention also is particularly effective when recycled polyurethane or other polymer resin, or materials derived by recycling polyurethane or other polymer resin, is incorporated into the product.

As indicated above, the fast-chemical-reaction-produced component can be one or more cover and/or core layers of the ball. When a polyurethane cover is formed according to the invention, and is then covered with a polyurethane top coat, excellent adhesion can be obtained. The adhesion in this case is better than adhesion of a polyurethane coating to an ionomeric cover. This improved adhesion can result in the use of a thinner top coat, the elimination of a primer coat, and the use of a greater variety of golf ball printing inks beneath the top coat. These include but are not limited to typical inks such as one component polyurethane inks and two component polyurethane inks.

The preferred method of forming a fast-chemical-reaction-produced component for a golf ball according to the invention is by reaction injection

molding (RIM). RIM is a process by which highly reactive liquids are injected into a closed mold, mixed usually by impingement and/or mechanical mixing in an in-line device such as a "peanut mixer", where they polymerize primarily in the mold to form a coherent, one-piece molded article. The RIM processes usually involve a rapid reaction between one or more reactive components such as polyether - or polyester - polyol, polyamine, or other material with an active hydrogen, and one or more isocyanate - containing constituents, often in the presence of a catalyst. The constituents are stored in separate tanks prior to molding and may be first mixed in a mix head upstream of a mold and then injected into the mold. The liquid streams are metered in the desired weight to weight ratio and fed into an impingement mix head, with mixing occurring under high pressure, e.g., 1500 - 3000 psi. The liquid streams impinge upon each other in the mixing chamber of the mix head and the mixture is injected into the mold. One of the liquid streams typically contains a catalyst for the reaction. The constituents react rapidly after mixing to gel and form polyurethane polymers. Polyureas, epoxies, and various unsaturated polyesters also can be molded by RIM.

RIM differs from non-reaction injection molding in a number of ways. The main distinction is that in RIM a chemical reaction takes place in the mold to transform a monomer or adducts to polymers and the components are in liquid form. Thus, a RIM mold need not be made to withstand the pressures which occur in a conventional injection molding. In contrast, injection molding is conducted at high molding pressures in the mold cavity by melting a solid resin and conveying it into a mold, with the molten resin often being at about 150 - 350°C. At this elevated temperature, the viscosity of the molten resin usually is in the range of 50,000 - 1,000,000 centipoise, and is typically around 200,000 centipoise. In an injection molding process, the solidification of the resins occurs after about 10 - 90 seconds, depending upon the size of the molded product, the temperature and heat transfer conditions, and the hardness of the injection molded material. Subsequently, the molded product is removed from

the mold. There is no significant chemical reaction taking place in an injection molding process when the thermoplastic resin is introduced into the mold. In contrast, in a RIM process, the chemical reaction typically takes place in less than about two minutes, preferably in under one minute, and in many cases in about 30 seconds or less.

If plastic products are produced by combining components that are performed to some extent, subsequent failure can occur at a location on the cover which is along the seam or parting line of the mold. Failure can occur at this location because this interfacial region is intrinsically different from the remainder of the cover layer and can be weaker or more stressed. The present invention is believed to provide for improved durability of a golf ball cover layer by providing a uniform or "seamless" cover in which the properties of the cover material in the region along the parting line are generally the same as the properties of the cover material at other locations on the cover, including at the poles. The improvement in durability is believed to be a result of the fact that the reaction mixture is distributed uniformly into a closed mold. This uniform distribution of the injected materials eliminates knit-lines and other molding deficiencies which can be caused by temperature difference and/or reaction difference in the injected materials. The process of the invention results in generally uniform molecular structure, density and stress distribution as compared to conventional injection-molding processes.

The fast-chemical-reaction-produced component has a flex modulus of 5 - 310 kpsi, more preferably 5 - 100 kpsi, and most preferably 5 - 50 kpsi. The subject component can be a cover with a flex modulus which is higher than that of the centermost component of the cores, as in a liquid center core and some solid center cores. Furthermore, the fast-chemical-reaction-produced component can be a cover with a flex modulus that is higher than that of the immediately underlying layer, as in the case of a wound core. The core can be one piece or multi-layer, each layer can be either foamed or unfoamed, and

density adjusting fillers, including metals, can be used. The cover of the ball can be harder or softer than any particular core layer.

The fast-chemical-reaction-produced component can incorporate suitable additives and/or fillers. When the component is an outer cover layer, pigments or dyes, accelerators and UV stabilizers can be added. Examples of suitable optical brighteners which probably can be used include Uvitex and Eastobrite OB-1. An example of a suitable white pigment is titanium dioxide. Examples of suitable and UV light stabilizers are provided in commonly assigned U.S. Patent No. 5,494,291. Fillers which can be incorporated into the fast-chemical-reaction-produced cover or core component include those listed below in the definitions section. Furthermore, compatible polymeric materials can be added. For example, when the component comprises polyurethane and/or polyurea, such polymeric materials include polyurethane ionomers, polyamides, etc.

A golf ball core layer formed from a fast-chemical-reaction-produced material according to the present invention typically contains 0 - 20 weight percent of such filler material, and more preferably 1 - 15 weight percent. When the fast-chemical-reaction-produced component is a core, the additives typically are selected to control the density, hardness and/or COR.

A golf ball inner cover layer formed from a fast-chemical-reaction-produced material according to the present invention typically contains 0 - 60 weight percent of filler material, more preferably 1 - 30 weight percent, and most preferably 1 - 20 weight percent.

A golf ball outer cover layer formed from a fast-chemical-reaction-produced material according to the present invention typically contains 0 - 20 weight percent of filler material, more preferably 1 - 10 weight percent, and most preferably 1 - 5 weight percent.

Catalysts can be added to the RIM polyurethane system starting materials as long as the catalysts generally do not react with the constituent with which

they are combined. Suitable catalysts include those which are known to be useful with polyurethanes and polyureas.

The reaction mixture viscosity should be sufficiently low to ensure that the empty space in the mold is completely filled. The reactant materials generally are preheated to 100 - 150°F before they are mixed. In most cases it is necessary to preheat the mold to, e.g., 100 - 120°F, to ensure proper injection viscosity.

As indicated above, one or more cover layers of a golf ball can be formed from a fast-chemical-reaction-produced material according to the present invention.

Referring now to the drawings, and first to Fig. 1, a golf ball having a cover comprising a RIM polyurethane is shown. The golf ball 10 includes a polybutadiene core 12 and a polyurethane cover 14 formed by RIM.

Referring now to Fig. 2, a golf ball having a core comprising a RIM polyurethane is shown. The golf ball 20 has a RIM polyurethane core 22, and a RIM polyurethane cover 24.

Referring to Fig. 3, a multi-layer golf ball 30 is shown with a solid core 32 containing recycled RIM polyurethane, a mantle cover layer comprising RIM polyurethane, and an outer cover layer comprising ionomer or another conventional golf ball cover material. Non-limiting examples of multi-layer golf balls according to the invention with two cover layers include those with RIM polyurethane mantles having a thickness of 0.02 - 0.20 inches and a Shore D hardness of 20 - 80, covered with ionomeric or non-ionomeric thermoplastic, balata or other covers having a Shore D hardness of 20 - 80 and a thickness of 0.025 - 0.20 inches.

Referring next to Fig. 4, a process flow diagram for forming a RIM cover of polyurethane is shown. Isocyanate from bulk storage is fed through line 80 to an isocyanate tank 100. The isocyanate is heated to the desired temperature, e.g. 100 - 120°F, by circulating it through heat exchanger 82 via lines 84 and 86. Polyol, polyamine, or another compound with an active hydrogen atom is

conveyed from bulk storage to a polyol tank 108 via line 88. The polyol is heated to the desired temperature, e.g. 100 - 120°F, by circulating it through heat exchanger 90 via lines 92 and 94. Dry nitrogen gas is fed from nitrogen tank 96 to isocyanate tank 100 via line 97 and to polyol tank 108 via line 98. Isocyanate is fed from isocyanate tank 100 via line 102 through a metering cylinder or metering pump 104 into recirculation mix head inlet line 106. Polyol is fed from polyol tank 108 via line 110 through a metering cylinder or metering pump 112 into a recirculation mix head inlet line 114. The recirculation mix head 116 receives isocyanate and polyol, mixes them, and provides for them to be fed through nozzle 118 into injection mold 120. The injection mold 120 has a top mold 122 and a bottom mold 124. Coolant flows through cooling lines 126 in the top mold 122 and lines 128 in the bottom mold 124. The materials are kept under controlled temperature conditions to insure that the desired reaction profile is maintained.

The polyol component typically contains additives, such as stabilizers, flow modifiers, catalysts, combustion modifiers, blowing agents, fillers, pigments, optical brighteners, and release agents to modify physical characteristics of the cover. Recycled polyurethane/polyurea also can be added to the core. Polyurethane/polyurea constituent molecules that were derived from recycled polyurethane can be added in the polyol component.

Inside the mix head, injector nozzles impinge the isocyanate and polyol at ultra-high velocity to provide excellent mixing. Additional mixing preferably is conducted using an aftermixer 130, which typically is constructed inside the mold between the mix head and the mold cavity.

As is shown in Fig 5, the mold includes a golf ball cavity chamber 132 in which a spherical golf ball mold 134 with a dimpled, spherical mold cavity 136 is positioned. The aftermixer 130 can be a peanut aftermixer, as is shown in Fig 5, or in some cases another suitable type, such as a heart, harp or dipper. An overflow channel 138 receives overflow material from the golf ball mold 134 through a shallow vent 136. Cooling water passages 138, which preferably are

in a parallel flow arrangement, carry cooling water through the top mold 122 and the bottom mold 124.

The mold cavity contains retractable pins and is generally constructed in the same manner as a mold cavity used to injection mold a thermoplastic, e.g., ionomeric golf ball cover. However, a few differences when RIM is used are that tighter pin tolerances generally are required, a lower mold temperature is used, and a lower injection pressure is used. Also, the molds can be produced from lower strength material such as aluminum.

The golf balls formed according to the present invention can be coated using a conventional two-component spray coating or can be coated during the RIM process, i.e., using an in-mold coating process.

One of the significant advantages of the RIM process according to the invention is that polyurethane or other cover material can be recycled and used in golf ball cores. Recycling can be conducted by, e.g., glycolysis. Typically, 10 - 80% of the material which is injection molded actually becomes part of the cover. The remaining 20 - 90% is recycled.

Recycling of polyurethanes by glycolysis is known from, for example, RIM Part and Mold Design - Polyurethanes, 1995, Bayer Corp., Pittsburgh, PA. Another significant advantage of the present invention is that because reaction injection molding occurs at low temperatures and pressures, i.e., 120 - 180°F and 100 - 200 psi, this process is particularly beneficial when a cover is to be molded over a very soft core. When higher pressures are used for molding over soft cores, the cores "shut off" i.e., deform and impede the flow of material causing uneven distribution of cover material.

One polyurethane component which can be used in the present invention incorporates TMXDI (META) aliphatic isocyanate (Cytec Industries, West Paterson, NJ). Polyurethanes based on meta-tetramethylxylyliene diisocyanate can provide improved gloss retention UV light stability, thermal stability hydrolytic stability. Additionally, TMXDI (META) aliphatic isocyanate has demonstrated favorable toxicological properties. Furthermore, because it has a

low viscosity, it is usable with a wider range of diols (to polyurethane) and diamines (to polyureas). If TMXDI is used, it typically, but not necessarily, is added as a direct replacement for some or all of the other aliphatic isocyanates in accordance with the suggestions of the supplier. Because of slow reactivity of TMXDI, it may be useful or necessary to use catalysts to have practical demolding times. Hardness, tensile strength and elongation can be adjusted by adding further materials in accordance with the supplier's instructions.

Golf ball cores also can be made using the materials and processes of the invention. To make a golf ball core using RIM polyurethane, the same processing conditions are used as are described above with respect to covers. One difference is, of course, that no retractor pins are needed in the mold. Furthermore, an undimpled, smaller mold is used. If, however, a one piece ball is desired, a dimpled mold would be used. Polyurethanes also can be used for cores.

Golf balls typically have indicia and/or logos stamped or formed thereon. Such indicia can be applied by printing using a material or a source of energetic particles after the ball core and/or cover have been reaction-injection-molded according to the present invention. Printed indicia can be formed form a material such as ink, foil (for use in foil transfer), etc. Indicia printed using a source of energetic particles or radiation can be applied by burning with a laser, burning with heat, directed electrons, or light, phototransformations of, e.g., UV ink, impingement by particles, impingement by electromagnetic radiation etc. Furthermore, the indicia can be applied in the same manner as an in-mold coating, i.e., by applying to the indicia to the surface of the mold prior to molding of the cover.

The polyurethane which is selected for use as a golf ball cover preferably has a Shore D hardness of 40 - 75, more preferably 40 - 60, and most preferably 40 - 50 for a soft cover layer and 50 - 60 for a hard cover layer. The polyurethane which is to be used for a cover layer preferably has a flex modulus

of 5 - 310 kpsi, more preferably 5 - 100 kpsi, and most preferably 5 -20 kpsi for a soft cover layer and 30 - 40 kpsi for a hard cover layer.

Non-limiting examples of suitable RIM systems for use in the present invention are Bayflex® elastomeric polyurethane RIM systems, Baydur® GS solid polyurethane RIM systems, Prism® solid polyurethane RIM systems, all from Bayer Corp. (Pittsburgh, PA), SPECTRIM reaction moldable polyurethane and polyurea systems from Dow Chemical USA (Midland, MI), including SPECTRIM MM 373-A (isocyanate) and 373-B (polyol), and Elastolit SR systems from BASF (Parsippany, NJ). Preferred RIM systems include Bayflex® MP-10000 and Bayflex® 110-50, filled and unfilled. Further preferred examples are polyols, polyamines and isocyanates formed by processes for recycling polyurethanes and polyureas. Peroxides, such as MEK-peroxide and dicumyl peroxide can be used. Furthermore, catalysts or activators such as cobalt octoate 6% can be used.

The following examples are included for purposes of illustration and are not intended to be limiting.

Example 1

A polybutadiene golf ball core having a diameter of 1.545", a PGA compression of about 65 and a coefficient of restitution of about 0.770 was obtained. A dimpled cover having a thickness of 0.0675" was reaction injection molded over the core. The cover comprised Bayflex MP 10000 resin (Bayer). The resulting ball had a PGA compression of 78, a COR of 0.720 and a Shore D cover hardness of 39. The ball met standard durability tests and had an excellent scuff resistance rating of 1. It is expected that this cover also has an excellent cut resistance rating.

Example 2 (Prophetic)

A golf ball core formed from high cis polybutadiene, zinc diacrylate, zinc oxide, zinc stearate, and peroxide initiator is obtained. The core has a diameter of 1.49".

The core is covered with a 0.04" thick mantle layer of RIM polyurethane which has a plaque Shore D hardness of 58, namely Bayflex® 110-50 unfilled (Bayer Corp.). The mantle layer is covered with a 0.055" thick dimpled outer cover layer of Iotek 8000, 7510 and 7030, and a whitener package. The formulation and properties of the golf ball are shown below on Table 1.

Example 3 (Prophetic)

A golf ball core formed from high-cis polybutadiene, zinc diacrylate, zinc oxide, zinc stearate and peroxide imitator is obtained. The core has a diameter of 1.49".

The core is covered with a 0.040" thick mantle layer of RIM polyurethane having a plaque Shore A hardness of about 90, namely Bayflex® MP 10000 unfilled (Bayer Corp.). The mantle layer is covered with a 0.055" thick dimpled outer cover layer of Ex 1006 and 1007 (Exxon Corp.) and Iotek 7030 (Exxon Corp.). The formulations and properties of the golf ball are shown below in Table 1.

Example 4 (Prophetic)

A golf ball core formed from high-cis polybutadiene, zinc diacrylate, zinc oxide, zinc stearate, and peroxide initiator is obtained. The core has a diameter of 1.49".

The core is covered with a 0.055" thick mantle layer of Iotek 1002 and 1003 (Exxon Corp.). The mantle layer is covered with a 0.04" thick dimpled outer cover layer of RIM Bayflex® MP10000 unfilled (Bayer Corp.). The formulation and properties of the golf ball are shown below on Table 1.

Example 5 (Prophetic)

A golf ball core having a diameter of 1.42" is formed from an elastomeric unfilled RIM polyurethane (Bayflex® MP10000, Bayer Corp.). The core is covered with a 0.08" thick injection-molded mantle layer of 50 parts by weight Iotek 1002 and 50 parts by weight Iotek 1003. The mantle layer is covered with a 0.050" thick injection-molded outer cover layer of Ex 1006, Ex 1007, Iotek

7030, and whitener. The formulation and properties of the golf ball are shown below on Table 1.

TABLE 1

Chemical Component	Example 2	Example 3	Example 4	Example 5
Core Data				
Size	1.49"	1.49"	1.49"	1.42"
Type				
Polybutadiene	Y	Y	Y	---
RIM Polyurethane	---	---	---	Y
Inner Cover Layer				
Size	1.57"	1.57"	1.57"	1.58"
Weight	38g	---	38g	---
Thickness	0.040"	0.040"	0.055"	0.080"
Hardness (Shore A or D)	58D plaque	90A plaque	70D	70D
Composition (wt %)				
Iotek 1002	---	---	50	50
Iotek 1003	---	---	50	50
Bayflex 110-50 unfilled	100	---	---	---
Bayflex MP 10000	---	100	---	---

TABLE 1

CONTINUED

Outer Cover Layer	**Example 2**	**Example 3**	**Example 4**	**Example 5**
Hardness (Shore A or D)	57D	64D	90A plaque	64D
Thickness	0.055"	0.055"	0.040"	0.050"
Composition (wt %)				
Bayflex MP 10000	---	---	100	---
Exxon 1006	---	46.4	---	46.4
Exxon 1007	---	46.4	---	46.4
Iotek 8000	33.8%	---	---	---
Iotek 7510	58.9%	---	---	---
Iotek 7030	7.3	7.2	---	7.2
Whitener Package				
Unitane 0-110 (phr)	2.3	2.3	2.3	2.3
Eastobrite OB1 (phr)	0.025	0.025	0.025	0.025
Ultra Marine Blue (phr)	0.004	0.004	0.004	0.004
Final Ball Data				
Size	1.68"	1.68"	1.68"	1.68"
Weight	45.4g	45.4g	45.4g	45.4g
COR (X 1000)	770-780	770-780	770-780	770-780

Definitions

Fillers

In a particularly preferred form of the invention, at least one layer of the golf ball contains at least one part by weight of a filler. Fillers preferably are used to adjust the density, flex modulus, mold release, and/or melt flow index of a layer. More preferably, at least when the filler is for adjustment of density or flex modulus of a layer, it is present in an amount of at least five parts by weight based upon 100 parts by weight of the layer composition. With some fillers, up to about 200 parts by weight probably can be used.

A density adjusting filler according to the invention preferably is a filler which has a specific gravity which is at least 0.05 and more preferably at least 0.1 higher or lower than the specific gravity of the layer composition. Particularly preferred density adjusting fillers have specific gravities which are higher than the specific gravity of the resin composition by 0.2 or more, even more preferably by 2.0 or more.

A flex modulus adjusting filler according to the invention is a filler which, when used in an amount of e.g. 1 - 100 parts by weight based upon 100 parts by weight of resin composition, will raise or lower the flex modulus (ASTM D-790) of the resin composition by at least 1% and preferably at least 5% as compared to the flex modulus of the resin composition without the inclusion of the flex modulus adjusting filler.

A mold release adjusting filler is a filler which allows for the easier removal of a part from a mold, and eliminates or reduces the need for external release agents which otherwise could be applied to the mold. A mold release adjusting filler typically is used in an amount of up to about 2 weight percent based upon the total weight of the layer.

A melt flow index adjusting filler is a filler which increases or decreases the melt flow, or ease of processing of the composition.

The layers may contain coupling agents that increase adhesion of materials within a particular layer e.g. to couple a filler to a resin composition,

or between adjacent layers. Non-limiting examples of coupling agents include titanates, zirconates and silanes. Coupling agents typically are used in amounts of 0.1 - 2 weight percent based upon the total weight of the composition in which the coupling agent is included.

A density adjusting filler is used to control the moment of inertia, and thus the initial spin rate of the ball and spin decay. The addition in one or more layers, and particularly in the outer cover layer of a filler with a lower specific gravity than the resin composition results in a decrease in moment of inertia and a higher initial spin rate than would result if no filler were used. The addition in one or more of the cover layers, and particularly in the outer cover layer of a filler with a higher specific gravity than the resin composition, results in an increase in moment of inertia and a lower initial spin rate. High specific gravity fillers are preferred as less volume is used to achieve the desired inner cover total weight. Nonreinforcing fillers are also preferred as they have minimal effect on COR. Preferably, the filler does not chemically react with the resin composition to a substantial degree, although some reaction may occur when, for example, zinc oxide is used in a shell layer which contains some ionomer.

The density-increasing fillers for use in the invention preferably have a specific gravity in the range of 1.0 - 20. The density-reducing fillers for use in the invention preferably have a specific gravity of 0.06 - 1.4, and more preferably 0.06 - 0.90. The flex modulus increasing fillers have a reinforcing or stiffening effect due to their morphology, their interaction with the resin, or their inherent physical properties. The flex modulus reducing fillers have an opposite effect due to their relatively flexible properties compared to the matrix resin. The melt flow index increasing fillers have a flow enhancing effect due to their relatively high melt flow versus the matrix. The melt flow index decreasing fillers have an opposite effect due to their relatively low melt flow index versus the matrix.

Fillers which may be employed in layers other than the outer cover layer may be or are typically in a finely divided form, for example, in a size generally

less than about 20 mesh, preferably less than about 100 mesh U.S. standard size, except for fibers and flock, which are generally elongated. Flock and fiber sizes should be small enough to facilitate processing. Filler particle size will depend upon desired effect, cost, ease of addition, and dusting considerations. The filler preferably is selected from the group consisting of precipitated hydrated silica, clay, talc, asbestos, glass fibers, aramid fibers, mica, calcium metasilicate, barium sulfate, zinc sulfide, lithopone, silicates, silicon carbide, diatomaceous earth, polyvinyl chloride, carbonates, metals, metal alloys, tungsten carbide, metal oxides, metal stearates, particulate carbonaceous materials, micro balloons, and combinations thereof. Non-limiting examples of suitable fillers, their densities, and their preferred uses are as follows:

FILLER TABLE

Filler Type	Spec. Grav.	Comments
Precipitated hydrated silica	2	1,2
Clay	2.62	1,2
Talc	2.85	1,2
Asbestos	2.5	1,2
Glass fibers	2.55	1,2
Aramid fibers (KEVLAR®)	1.44	1,2
Mica	2.8	1,2
Calcium metasilicate	2.9	1,2
Barium sulfate	4.6	1,2
Zinc sulfide	4.1	1,2
Lithopone	4.2 - 4.3	1,2
Silicates	2.1	1,2
Silicon carbide platelets	3.18	1,2
Silicon carbide whiskers	3.2	1,2
Tungsten carbide	15.6	1
Diatomaceous earth	2.3	1,2
Polyvinyl chloride	1.41	1,2

Carbonates		
Calcium carbonate	2.71	1,2
Magnesium carbonate	2.2	1,2
Metals and Alloys (powders)		
Titanium	4.51	1
Tungsten	19.35	1
Aluminum	2.7	1
Bismuth	9.78	1
Nickel	8.9	1
Molybdenum	10.2	1
Iron	7.86	1
Steel	7.8 - 7.9	1
Lead	11.4	1,2
Copper	8.94	1
Brass	8.2 - 8.4	1
Boron	2.34	1
Boron carbide whiskers	2.52	1,2
Bronze	8.70 - 8.74	1
Cobalt	8.92	1
Beryllium	1.84	1
Zinc	7.14	1
Tin	7.31	1
Metal Oxides		
Zinc oxide	5.57	1,2
Iron oxide	5.1	1,2
Aluminum oxide	4	
Titanium oxide	3.9 - 4.1	1,2
Magnesium oxide	3.3 - 3.5	1,2
Zirconium oxide	5.73	1,2

Metal Stearates		
Zinc stearate	1.09	3,4
Calcium stearate	1.03	3,4
Barium stearate	1.23	3,4
Lithium stearate	1.01	3,4
Magnesium stearate	1.03	3,4
Particulate carbonaceous materials		
Graphite	1.5 - 1.8	1,2
Carbon black	1.8	1,2
Natural bitumen	1.2 - 1.4	1,2
Cotton flock	1.3 - 1.4	1,2
Cellulose flock	1.15 - 1.5	1,2
Leather fiber	1.2 - 1.4	1,2
Micro balloons		
Glass	0.15 - 1.1	1,2
Ceramic	0.2 - 0.7	1,2
Fly ash	0.6 - 0.8	1,2
Coupling Agents Adhesion Promoters		
Titanates	0.95 - 1.17	
Zirconates	0.92 - 1.11	
Silane	0.95 - 1.2	

COMMENTS:

1 Particularly useful for adjusting density of the cover layer.
2 Particularly useful for adjusting flex modulus of the cover layer.
3 Particularly useful for adjusting mold release of the cover layer.
4 Particularly useful for increasing melt flow index of the cover layer.

All fillers except for metal stearates would be expected to reduce the melt flow index of an injection molded cover layer.

The amount of filler employed is primarily a function of weight requirements and distribution.

Scuff Resistance

The scuff resistance test was conducted in the following manner: a Top-Flite tour pitching wedge (1994) with box grooves was obtained and was mounted in a Miyamae driving machine. The club face was oriented for a square hit. The forward/backward tee position was adjusted so that the tee was four inches behind the point in the downswing where the club was vertical. The height of the tee and the toe-heel position of the club relative to the tee were adjusted in order that the center of the impact mark was about 3/4 of an inch above the sole and was centered to the heel across the face. The machine was operated at a club head speed of 125 feet per second. A minimum of three samples of each ball were tested. Each ball was hit three times. After testing, the balls were rated according to the following table:

Rating	Type of Damage
1	Little or no damage (groove markings or dents)
2	Small cuts and/or ripples in cover
3	Moderate amount of material lifted from ball surface, but still attached to ball
4	Material removed or barely attached

The balls that were tested were primed and top coated.

Cut Resistance

Cut resistance was measured in accordance with the following procedure: A golf ball was fired at 135 feet per second against the leading edge of a 1994 Top-Flite Tour pitching wedge, wherein the leading edge radius is 1/32 inch, the loft angle is 51 degrees, the sole radius is 2.5 inches, and the bounce angle is 7 degrees.

The cut resistance of the balls tested herein was evaluated on a scale of 1 - 5. A 5 represents a cut that extends completely through the cover to the core; a 4 represents a cut that does not extend completely through the cover but that

does break the surface; a 3 does not break the surface of the cover but does leave a permanent dent; a 2 leaves only a slight crease which is permanent but not as severe as 3; and a 1 represents virtually no visible indentation or damage of any sort.

Durability

Durability is determined by firing a golf ball at 135 ft/sec (at 72°F) into 5-sided steel pentagonal container, the walls of which are steel plates. The container 10, which is shown schematically in Fig. 1, has a 19 1/2 inch long insert plate 12 mounted therein, the central portion 14 of which has horizontally extending square grooves on it which are intended to simulate a square grooved face of a golf club. The grooves, which are shown in an exaggerated form in Fig. 2, have a width 30 of 0.033 inches, a depth 32 of 0.100 inches, and are spaced apart from one another by land areas 34 having a width of 0.130 inches. The five walls 16 of the pentagonal container each have a length of 14 1/2 inches. The inlet wall is vertical and the insert plate is mounted such that it inclines upward 30° relative to a horizontal plane away from opening 20 in container 10. The ball travels 15 1/2 - 15 3/4 inches horizontally from its point of entry into the container 10 until it hits the square-grooved central portion 14 of insert plate 12. The angle between the line of trajectory of the ball and the insert plate 12 is 30°. The balls are subjected to 70 or more blows (firings) and are inspected at regular intervals for breakage (i.e., any signs of cover cracking or delamination). If a microcrack forms in a ball, its speed will change and the operator is alerted. The operator then visually inspects the ball. If the microcrack cannot yet be observed, the ball is returned to the test until a crack can be visually detected.

A ball is assigned a Durability Rating according to the following scale. A sample of twelve balls of the same type are obtained and are tested using the durability test apparatus described in the previous paragraph. If less than all of the balls in the sample survive 70 blows each without cracking, the ball is assigned a Durability Rating of 1. If all of the balls survive 70 blows and one or

two of the twelve balls crack before 100 blows, the ball is assigned a Durability Rating of 2. If all twelve balls in the sample survive 100 blows each, but seven or more balls crack at less than 200 blows each, the ball is assigned a Durability Rating of 3. If all twelve balls in the sample survive 100 blows and at least six out of the twelve balls in the sample also survive 200 blows, the balls is assigned a Durability Rating of 4.

Shore D Hardness

As used herein, "Shore D hardness" of a cover is measured generally in accordance with ASTM D-2240, except the measurements are made on the curved surface of a molded cover, rather than on a plaque. Furthermore, the Shore D hardness of the cover is measured while the cover remains over the core. When a hardness measurement is made on a dimpled cover, Shore D hardness is measured at a land area of the dimpled cover.

Coefficient of Restitution

The resilience or coefficient of restitution (COR) of a golf ball is the constant "e," which is the ratio of the relative velocity of an elastic sphere after direct impact to that before impact. As a result, the COR ("e") can vary from 0 to 1, with 1 being equivalent to a perfectly or completely elastic collision and 0 being equivalent to a perfectly or completely inelastic collision.

COR, along with additional factors such as club head speed, club head mass, ball weight, ball size and density, spin rate, angle of trajectory and surface configuration (i.e., dimple pattern and area of dimple coverage) as well as environmental conditions (e.g. temperature, moisture, atmospheric pressure, wind, etc.) generally determine the distance a ball will travel when hit. Along this line, the distance a golf ball will travel under controlled environmental conditions is a function of the speed and mass of the club and size, density and resilience (COR) of the ball and other factors. The initial velocity of the club, the mass of the club and the angle of the ball's departure are essentially provided by the golfer upon striking. Since club head, club head mass, the angle of trajectory and environmental conditions are not determinants controllable by

golf ball producers and the ball size and weight are set by the U.S.G.A., these are not factors of concern among golf ball manufacturers. The factors or determinants of interest with respect to improved distance are generally the coefficient of restitution (COR) and the surface configuration (dimple pattern, ratio of land area to dimple area, etc.) of the ball.

The COR in solid core balls is a function of the composition of the molded core and of the cover. The molded core and/or cover may be comprised of one or more layers such as in multi-layered balls. In balls containing a wound core (i.e., balls comprising a liquid or solid center, elastic windings, and a cover), the coefficient of restitution is a function of not only the composition of the center and cover, but also the composition and tension of the elastomeric windings. As in the solid core balls, the center and cover of a wound core ball may also consist of one or more layers.

The coefficient of restitution is the ratio of the outgoing velocity to the incoming velocity. In the examples of this application, the coefficient of restitution of a golf ball was measured by propelling a ball horizontally at a speed of 125± 5 feet per second (fps) and corrected to 125 fps against a generally vertical, hard, flat steel plate and measuring the ball's incoming and outgoing velocity electronically. Speeds were measured with a pair of Oehler Mark 55 ballistic screens available from Oehler Research, Inc., P.O. Box 9135, Austin, Texas 78766, which provide a timing pulse when an object passes through them. The screens were separated by 36" and are located 25.25" and 61.25" from the rebound wall. The ball speed was measured by timing the pulses from screen 1 to screen 2 on the way into the rebound wall (as the average speed of the ball over 36"), and then the exit speed was timed from screen 2 to screen 1 over the same distance. The rebound wall was tilted 2 degrees from a vertical plane to allow the ball to rebound slightly downward in order to miss the edge of the cannon that fired it. The rebound wall is solid steel 2.0 inches thick.

As indicated above, the incoming speed should be 125 ±5 fps but corrected to 125 fps. The correlation between COR and forward or incoming speed has been studied and a correction has been made over the ±5 fps range so that the COR is reported as if the ball had an incoming speed of exactly 125.0 fps.

The coefficient of restitution must be carefully controlled in all commercial golf balls if the ball is to be within the specifications regulated by the United States Golf Association (U.S.G.A.). As mentioned to some degree above, the U.S.G.A. standards indicate that a "regulation" ball cannot have an initial velocity exceeding 255 feet per second in an atmosphere of 75 F. when tested on a U.S.G.A. machine. Since the coefficient of restitution of a ball is related to the ball's initial velocity, it is highly desirable to produce a ball having sufficiently high coefficient of restitution to closely approach the U.S.G.A. limit on initial velocity, while having an ample degree of softness (i.e., hardness) to produce enhanced playability (i.e., spin, etc.).

<u>Compression</u>

PGA compression is another important property involved in the performance of a golf ball. The compression of the ball can affect the playability of the ball on striking and the sound or "click" produced. Similarly, compression can effect the "feel" of the ball (i.e., hard or soft responsive feel), particularly in chipping and putting.

Moreover, while compression itself has little bearing on the distance performance of a ball, compression can affect the playability of the ball on striking. The degree of compression of a ball against the club face and the softness of the cover strongly influences the resultant spin rate. Typically, a softer cover will produce a higher spin rate than a harder cover. Additionally, a harder core will produce a higher spin rate than a softer core. This is because at impact a hard core serves to compress the cover of the ball against the face of the club to a much greater degree than a soft core thereby resulting in more "grab" of the ball on the clubface and subsequent higher spin rates. In effect the

cover is squeezed between the relatively incompressible core and clubhead. When a softer core is used, the cover is under much less compressive stress than when a harder core is used and therefore does not contact the clubface as intimately. This results in lower spin rates.

The term "compression" utilized in the golf ball trade generally defines the overall deflection that a golf ball undergoes when subjected to a compressive load. For example, PGA compression indicates the amount of change in golf ball's shape upon striking. The development of solid core technology in two-piece balls has allowed for much more precise control of compression in comparison to thread wound three-piece balls. This is because in the manufacture of solid core balls, the amount of deflection or deformation is precisely controlled by the chemical formula used in making the cores. This differs from wound three-piece balls wherein compression is controlled in part by the winding process of the elastic thread. Thus, two-piece and multilayer solid core balls exhibit much more consistent compression readings than balls having wound cores such as the thread wound three-piece balls.

In the past, PGA compression related to a scale of from 0 to 200 given to a golf ball. The lower the PGA compression value, the softer the feel of the ball upon striking. In practice, tournament quality balls have compression ratings around 70 - 110, preferably around 80 to 100.

In determining PGA compression using the 0 - 200 scale, a standard force is applied to the external surface of the ball. A ball which exhibits no deflection (0.0 inches in deflection) is rated 200 and a ball which deflects 2/10th of an inch (0.2 inches) is rated 0. Every change of .001 of an inch in deflection represents a 1 point drop in compression. Consequently, a ball which deflects 0.1 inches (100 x .001 inches) has a PGA compression value of 100 (i.e., 200 - 100) and a ball which deflects 0.110 inches (110 x .001 inches) has a PGA compression of 90 (i.e., 200 - 110).

In order to assist in the determination of compression, several devices have been employed by the industry. For example, PGA compression is

determined by an apparatus fashioned in the form of a small press with an upper and lower anvil. Theupper anvil is at rest against a 200-pound die spring, and the lower anvil is movable through 0.300 inches by means of a crank mechanism. In its open position the gap between the anvils is 1.780 inches allowing a clearance of 0.100 inches for insertion of the ball. As the lower anvil is raised by the crank, it compresses the ball against the upper anvil, such compression occurring during the last 0.200 inches of stroke of the lower anvil, the ball then loading the upper anvil which in turn loads the spring. The equilibrium point of the upper anvil is measured by a dial micrometer if the anvil is deflected by the ball more than 0.100 inches (less deflection is simply regarded as zero compression) and the reading on the micrometer dial is referred to as the compression of the ball. In practice, tournament quality balls have compression ratings around 80 to 100 which means that the upper anvil was deflected a total of 0.120 to 0.100 inches.

An example to determine PGA compression can be shown by utilizing a golf ball compression tester produced by Atti Engineering Corporation of Newark, N.J. The value obtained by this tester relates to an arbitrary value expressed by a number which may range from 0 to 100, although a value of 200 can be measured as indicated by two revolutions of the dial indicator on the apparatus. The value obtained defines the deflection that a golf ball undergoes when subjected to compressive loading. The Atti test apparatus consists of a lower movable platform and an upper movable spring-loaded anvil. The dial indicator is mounted such that it measures the upward movement of the springloaded anvil. The golf ball to be tested is placed in the lower platform, which is then raised a fixed distance. The upper portion of the golf ball comes in contact with and exerts a pressure on the springloaded anvil. Depending upon the distance of the golf ball to be compressed, the upper anvil is forced upward against the spring.

Alternative devices have also been employed to determine compression. For example, Applicant also utilizes a modified Riehle Compression Machine

originally produced by Riehle Bros. Testing Machine Company, Phil., PA to evaluate compression of the various components (i.e., cores, mantle cover balls, finished balls, etc.) of the golf balls. The Riehle compression device determines deformation in thousandths of an inch under a fixed initialized load of 200 pounds. Using such a device, a Riehle compression of 61 corresponds to a deflection under load of 0.061 inches.

Additionally, an approximate relationship between Riehle compression and PGA compression exists for balls of the same size. It has been determined by Applicant that Riehle compression corresponds to PGA compression by the general formula PGA compression = 160 - Riehle compression. Consequently, 80 Riehle compression corresponds to 80 PGA compression, 70 Riehle compression corresponds to 90 PGA compression, and 60 Riehle compression corresponds to 100 PGA compression. For reporting purposes, Applicant's compression values are usually measured as Riehle compression and converted to PGA compression.

Furthermore, additional compression devices may also be utilized to monitor golf ball compression so long as the correlation to PGA compression is know. These devices have been designed, such as a Whitney Tester, to correlate or correspond to PGA compression through a set relationship or formula.

What is claimed is:

1. A process of making a multi-piece golf ball comprising making at least one of a cover component and a core component of the ball by mixing two or more reactants that react and form a reaction product with a flex modulus of 5 - 310 kpsi in a reaction time of about 5 minutes or less, the component having a thickness of at least 0.01 inches and a demold time of 10 minutes or less.

2. A process according to claim 1, wherein the reaction product comprises at least one member selected from the group consisting of polyurethanes, polyureas, epoxies and unsaturated polyesters.

3. A process according to claim 1, wherein the reaction process comprises reaction injection molding.

4. A process according to claim 1, wherein the reaction product comprises at least one member selected from the group consisting of polyurethane and polyurea.

5. A process according to claim 4, wherein the reaction product with a flex modulus of 5 - 300 kpsi is formed in a reaction time of about 3 minutes or less.

6. A process according to claim 4, wherein the component has a thickness of at least 0.02 inches.

7. A process according to claim 4, wherein the component includes a cover component.

8. A process according to claim 7, wherein the cover component is a dimpled cover layer and the cover component has a thickness of at least 0.02 inches.

9. A process according to claim 7, wherein the cover component has a hardness of 20 - 95 Shore D.

10. A process according to claim 7, wherein the cover component has a hardness of 30 - 75 Shore D.

11. A process according to claim 1, wherein the component includes a core component.

12. A process according to claim 2, further including the step of recycling at least a portion of the reaction product.

13. A process according to claim 12, wherein the reaction product is recycled by glycolysis.

14. A multi-piece golf ball comprising a reaction injection molded material comprising polyurethane/polyurea.

15. A golf ball according to claim 14, wherein the reaction injection molded material comprising polyurethane/polyurea includes at least one of ether functional groups and ester functional groups.

16. A golf ball according to claim 14, wherein at least 5% of the polyurethane/polyurea is formed from molecules obtained by recycling a material comprising one of polyurethane, polyurea, polyester, and polyethylene glycol.

17. A golf ball according to claim 14, wherein recycling takes place by glycolysis.

18. A golf ball according to claim 14, wherein the ball has a core and a cover and at least the cover comprises reaction injection molded polyurethane/polyurea material.

19. A golf ball according to claim 18, wherein the ball includes an exterior coating surrounding the cover.

20. A golf ball according to claim 18, wherein the core is solid, multi-layer, wound, liquid filled, metal filled and/or foamed.

21. A golf ball according to claim 18, wherein the cover has a flex modules of 5 - 310 kpsi.

22. A golf ball according to claim 18, wherein the cover has a flex modulus of 5 - 100 kpsi.

23. A golf ball according to claim 18, wherein the exterior coating is applied over the cover after molding of the cover.

24. A golf ball according to claim 18, wherein the hardness of the cover is 20 - 95 Shore D.

25. A golf ball according to claim 18, wherein the hardness of the cover is 30 - 75 Shore D.

26. A golf ball according to claim 25, wherein the flexural modulus of the cover is in the range 5 to 100 kpsi.

27. A golf ball according to claim 18, wherein the flexural modulus of the cover is higher than that of the core.

28. A golf ball according to claim 18, wherein the ball has a multi-layer cover.

29. A golf ball according to claim 18, wherein the cover comprises a reaction injection molded material comprising polyurethane and further comprises at least one member selected from the group consisting of optical brightener, pigment, dye, antioxidant, and UV light stabilizer.

30. A golf ball according to claim 18, wherein the cover further comprises a filler.

31. A golf ball according to claim 30, wherein the filler includes at least one member selected from the group consisting of glass, metal, minerals, oxides, sulfides, titanates, polymeric resins and ceramics.

32. A golf ball according to claim 14, wherein the ball has a core and a cover, and at least the core comprises a reaction injection molded polyurethane/polyurea material.

33. A golf ball according to claim 30, wherein the core comprises at least two components and at least one core component comprises reaction injection molded polyurethane/polyurea material.

34. A golf ball according to claim 14, wherein the ball has a core, and a cover, each of which comprises reaction injection molded polyurethane/polyurea material.

35. A golf ball according to claim 30, wherein the cover comprises an ionomer.

36. A golf ball according to claim 14, wherein the polyurethane/polyurea material incorporates meta-tetramethylxylylene diisocyanate.

37. A golf ball according to claim 18, wherein the cover has a generally uniform consistency both at the seam and the poles.

38. A process for producing a golf ball including the step (a) of: reaction injection molding a polyurethane/polyurea material to form at least one of a core layer and a cover layer of the ball.

39. A process according to claim 36, further comprising the step of (b) recycling at least 20% of the polyurethane/polyurea that is produced in connection with step (a) but which is not incorporated into the ball during that step

40. A process for producing a golf ball comprising (a) forming a core, (b) covering the core, and (c) coating and adding indicia to the covered ball, wherein at least one of steps (a) and (b) comprises reaction injection molding of a polyurethane/polyurea material.

41. A process according to claim 38, further comprising the step of (d) recycling at least 20% of the RIM-produced material comprising polyurethane that was produced consequent to step (a).

42. A golf ball comprising at least one fast-chemical-reaction-produced layer, said layer having a flex modulus of 5 - 310 kpsi in a reaction time of 5 minutes or less and a thickness of at least 0.01".

43. A golf ball according to claim 42, wherein said ball has a multi-layer cover and said at least one fast-chemical-reaction-produced layer is an inner cover layer.

44. A golf ball having a core and a cover, the cover comprising polyurethane/polyurea which is formed from reactants, 5 - 100 weight percent of which are obtained from recycled polyurethane/polyurea.

ABSTRACT OF THE DISCLOSURE

Disclosed herein is a golf ball comprising fast-chemical-reaction-produced component, such as a component which comprises a reaction injection molded polyurethane material. A process of making a golf ball by forming at least one core and/or cover component of the ball by mixing two or more reactants that react and form a reaction product with a flex modulus of 5 - 310 kpsi in a reaction time of about 5 minutes or less, the component having a thickness of at least 0.01 inches and a demold time of 10 minutes or less is disclosed. In one preferred form of the invention, excess polyurethane from forming golf ball covers is recycled by using it to form golf ball cores.

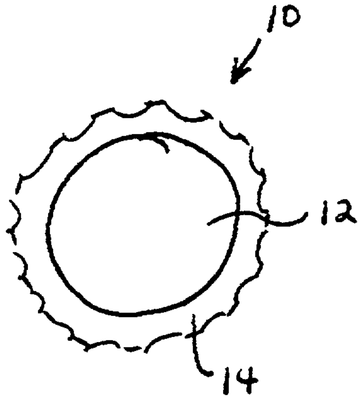

Fig. 1

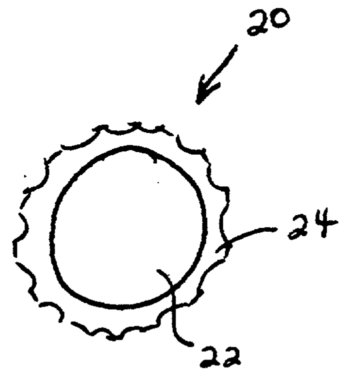

Fig. 2

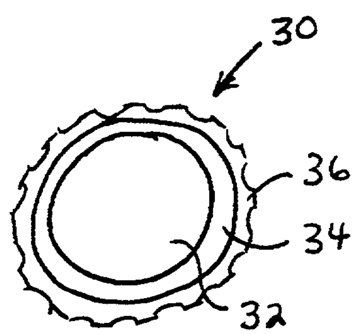

Fig. 3

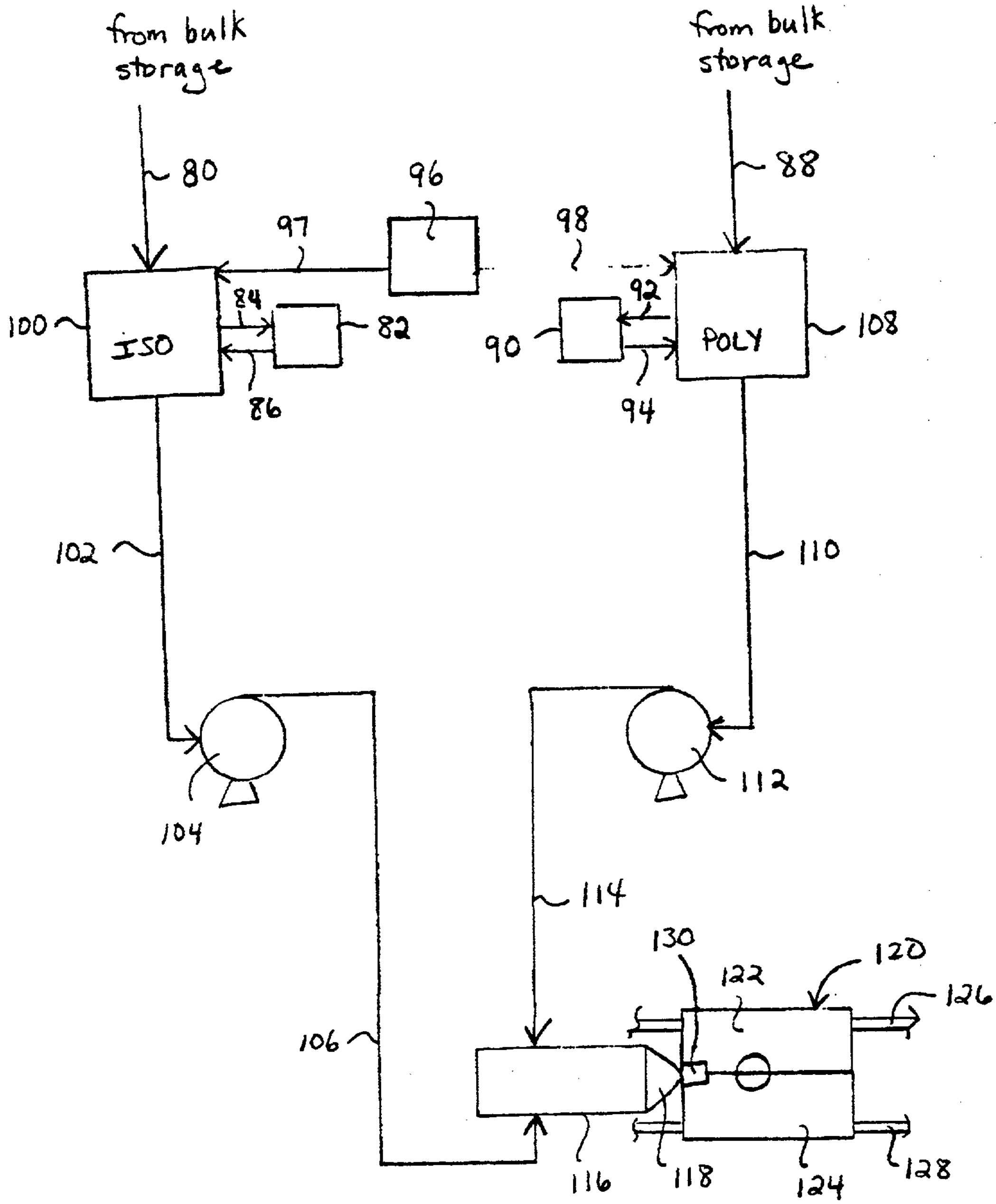
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fig. 4

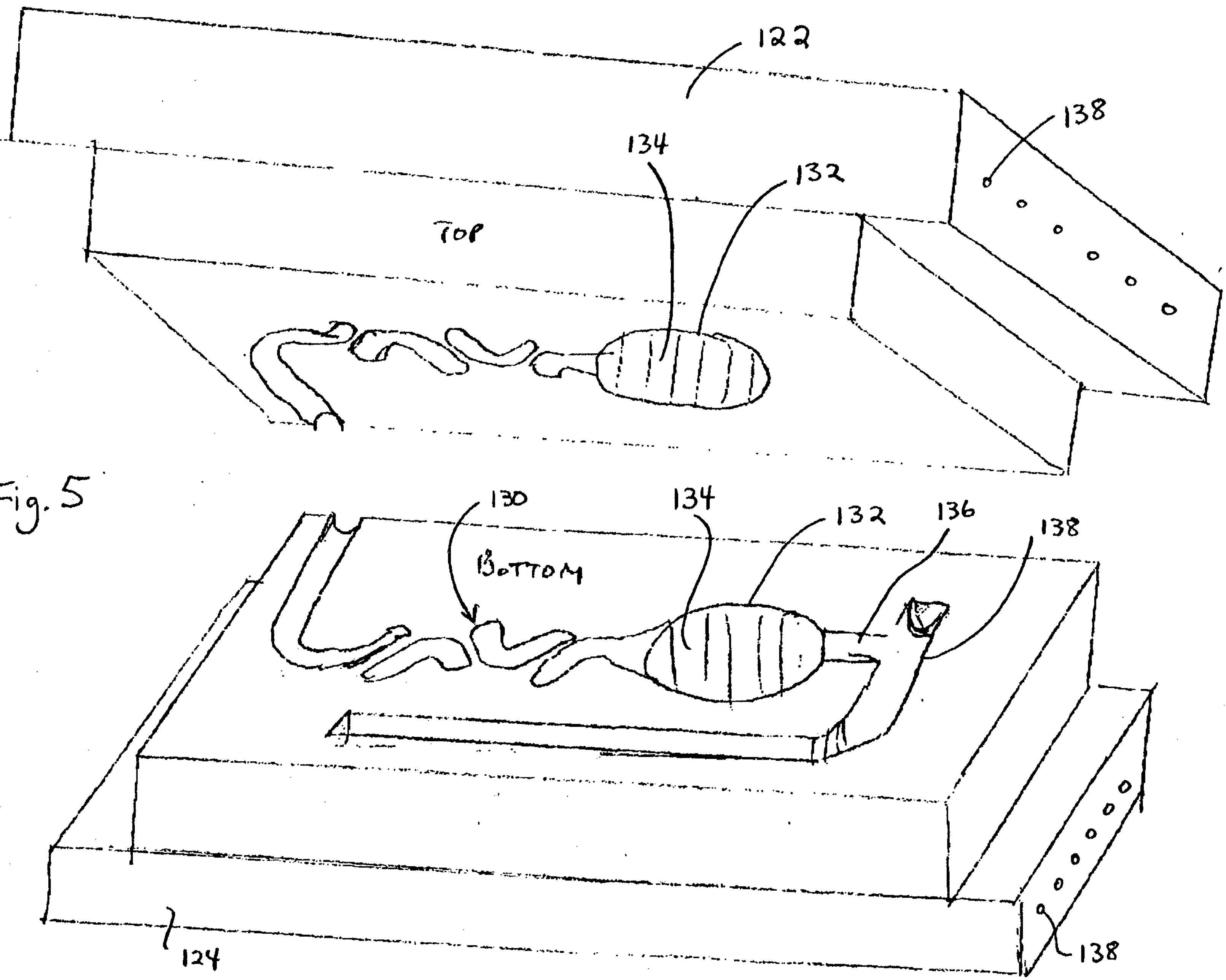

Fig. 5

Practitioner's Docket No. P-5550 **PATENT**

COMBINED DECLARATION AND POWER OF ATTORNEY
(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

X original
___ design
___ supplemental
___ divisional
___ continuation
___ continuation-in-part (C-I-P)
___ national stage of PCT,

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (If only one name is listed below) or an original, first and joint inventor (If plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION: Golf Ball Which Includes Fast-Chemical-Reaction-Produced Component and Method of Making Same

SPECIFICATION IDENTIFICATION

the specification of which:

(a) X is attached hereto.
(b) ___ was filed on ________, as Serial No. 08/______ and was amended on ________.
(c) ___ was described and claimed in PCT International Application No. ____________ filed on ________ and as amended under PCT Article 19 on ____________.

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

___ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

___ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, §§119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(d) X no such applications have been filed.
(e) __ such applications have been filed as follows

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

COUNTRY (OR INDICATE IF PCT	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
			YES NO

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)(34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER **FILING DATE**

_______/_______________________ _______________

CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S) UNDER 35 U.S.C. 120

I hereby claim the benefit, under Title 35, United States Code, § 120, of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112,1 acknowledge the duty to disclose information.

__ that is material to patentability as defined in 37, Code of Federal Regulations, § 1.56

__ and that is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent, that occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

In compliance with this duty, there is attached an information disclosure statement, in accordance with 37 C.F.R. 1.98.

PRIOR U.S. APPLICATION OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 USC 120:					
U.S. APPLICATIONS		Status (check one)			
U.S. APPLICATIONS		U.S. FILING DATE	Patented	Pending	Abandoned
/					
PCT APPLI-CATION NO.	PCT FILING DATE	U.S. APPLICATION NOS. ASSIGNED			
		/			

ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Donald R. Bahr	Registration No. 21011
Diane F. Covello	Registration No. 34164

__ hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

__ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

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(813) 204-5230

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

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Inventor's signature Country of Citizenship
Date
Residence
Post Office Address

Full name of fifth joint inventor, if any

(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)

Inventor's signature Country of Citizenship
Date
Residence
Post Office Address

___ Signature for sixth and subsequent joint inventors. Number of pages added ______.

* * *

___ Signature by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. Number of pages added ______.

* * *

___ Signature for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. Number of pages added ______.

* * *

___ Added page for signature by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 CFR 1.47)

* * *

___ Total Number of pages added ______.

* * *

___ Authorization of practitioner(s) to accept and follow instructions from representative.

* * *

X This declaration ends with this page.